

## **REMARKS**

Claims 1-8, 11 and 13-19 are pending in the present application. By this Amendment, in conjunction with the contemporaneously filed Request for Continued Examination, Applicants have amended claims 1 and 14, added new claims 16-19, and canceled claim 9. Applicants respectfully submit that the present application is in condition for allowance based on the discussion which follows.

As an initial comment, Applicants respectfully submit that added new claims 16-19 recite subject matter fully supported by the specification as filed and, therefore, do not constitute new matter. For example, paragraph [0028] of the published application (U.S. Patent Application Publication No. 2004/0167342) (hereinafter “the ‘342 publication”) fully supports the pore-forming material being added in amounts from 5 to 20% by weight and from 5 to 14% by weight.

In the final Office Action, claims 1-3, 5-7, 9, 11 and 13-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Grosch et al. (DE 19623611) (hereinafter “Grosch”), in view of Hefele et al. (WO 98/37965) (hereinafter “Hefele”), and further in view of Sepulveda et al. (U.S. Patent No. 4,613,427) (hereinafter “Sepulveda”). In maintaining the rejection in view of the aforementioned prior art references, in the Office Action’s Response to Amendment and Arguments section, it was alleged that the Declaration under 37 C.F.R. § 1.132, filed on August 29, 2008 (hereinafter “Strebelle Dec.”), remains insufficient, due to differences between the claimed method and those in the experiments of the Strebelle Dec.

Without addressing the merits of the current prior art rejections, and in order to move the case forward to allowance, by this Amendment, Applicants have amended independent claims 1 and 14 to now recite the specific titanium zeolite powder and quantity of plasticizer, in

accordance with the experiments of the Strebel Dec., and as previously recited in claims 2 and 9. As currently amended, the Strebel Dec. fully supports the novelty and non-obviousness of the claimed invention. Subject matter basis for the amendments to claims 1 and 14 can be found in the present application as filed, including the amount of plasticizer which was previously recited in claim 9. Subject matter basis for the specific titanium zeolite powder can be found in the present specification, page 2, lines 1-4, and claim 2. Accordingly, the amendments to the claims do not constitute new matter.

Applicants respectfully submit that it will be clear from comparing the Strebel Dec. and the present claims that the present claims are directed to a method which is fully supported by the examples of the Strebel Dec., as further summarized below.

The additional examples submitted in the Strebel Dec. are based on the following mixture:

- titanium zeolite powder which is TS-1,
- 4% of plasticizer (cellulose) by weight of TS-1,
- 6, 11 and 20% of binder (silicone binder) by weight of TS-1,
- 0, 10 and 20% of pore-forming substance (melamine) by weight of TS-1, and
- 60% of water by weight of TS-1.

Amended claims now recite that in the mixture of step (a):

- the titanium zeolite is TS-1,
- the plasticizer is used in an amount from 1 to less than 10% by weight of TS-1,
- the binder is a silicon derivative binder, used in an amount of more than 5% and less than 20% by weight of TS-1,
- the pore-forming substance is used in an amount from 5 to 35% by weight of TS-1, and
- the plasticizer and the pore-forming substance are distinct from one another.

Further, although the nature of the pore-forming substance is not specifically defined in the present claims, the nature of pore-forming substances are well known in the art. Therefore, it

is unnecessary to include additional details in description of these substances beyond what is described in the Strebelle Dec. Support for this can be found in the Examiner cited prior art of Hefele (e.g., column 7, lines 7-12) and Sepulveda (column 4, lines 17-21), which disclose various kinds of pore-forming substances, without identifying differences regarding their properties and, therefore, the respective inventors consider them as equivalents. Accordingly, the claimed method is consistent with the examples of the Strebelle Dec., and vice versa, to fully support the novelty of the claimed method.

In addition, the nature of the plasticizer is not specifically defined in the present claims, as, again, the prior art of Grosch (column 1, line 22-column 2, line 2) does not make a distinction between plasticizers, in accordance with its method in this art. Accordingly, in this art, further definition of the plasticizer is unnecessary in order to establish novelty, and in order to practice the invention as claimed. Therefore, the examples in the Strebelle Dec. demonstrating properties, features and advantages over the prior art are commensurate in scope with the pending claims.

Now considering that the Strebelle Dec. is commensurate in scope with the claims, Applicants respectfully submit that the Strebelle Dec. is sufficient and does demonstrate novelty and non-obviousness of the present method over the cited prior art references. Specifically responding to the Examiner's comment in the final rejection of November 19, 2008 (cited in the current final Office Action) questioning whether the example in the Strebelle Dec. with regard to the pore-forming substance produced an unexpected result as the same rate constant ( $k$ ) was obtained in the absence of the use of melamine and 6 g of binder (Ex. 1) compared to 10 g of melamine and 20 g of binder (Ex. 5), Applicants respectfully submit that it appears that the Examiner has not taken into consideration that a good compromise must be found between

mechanical strength (weight loss through attrition) and catalyst activity (kinetic constant related to  $\text{H}_2\text{O}_2$ ). Furthermore, in view of the amended claims, Examples 1 and 5 are actually comparative examples. Indeed, in Ex. 1, no pore-forming substance is added and, in Ex. 5, 20% binder is added. Thus, Examples 1 and 5 are directed outside the scope of the amended claims, in that the amended claims recite more than 5% and less than 20% binder. Further, although the Strebelle Dec. does not include specific examples in which the pore-forming substance is added in amounts at the lower and upper limits of the present claims, i.e. 5% and 35%, one skilled in the art will be able to readily extrapolate the summarized results from the data regarding 10 and 20% pore-forming material, thereby supporting the full scope of the claimed invention.

Moreover, Applicants respectfully submit that one of ordinary skill in the art would not have been led to combine aspects of Grosch and Hefele together to in any way find the claimed method obvious, which will be apparent based on the discussion of the prior art references. Applicants respectfully traverse the obviousness-type rejection in view of Grosch and Hefele and the assertion by the Examiner that it would have been obvious to one of ordinary skill in the art to apply the disclosure of Grosch, which states that its titanium zeolite can be manufactured using techniques disclosed in two prior art references (i.e. EP 03 11 983 [hereinafter "EP '983"] and EP 04 05 978 [hereinafter "EP '978"]], based on an allegation that the aforementioned EP references disclosed using titanium dioxide as a starting material to manufacture titanium zeolite. To the contrary, one of ordinary skill in the art would not have used a pore-forming material disclosed in Hefele (titanium dioxide catalyst) with the titanium zeolite of Grosch, as there fails to be any apparent reason why one of ordinary skill in the art would have been led to combine the aforementioned references. One of ordinary skill in the art would not have seen any problem

with their respective references or any benefit from combining various aspects of the two references and, therefore, in accordance with *KSR Int'l v. Teleflex, Inc.*, it would not have been obvious to one of ordinary skill in the art to combine the two references, as will be apparent based on the discussion of the respective disclosures and combined teachings. The following discussion of the prior art further highlights why one skilled in the art would not have combined various aspects of Grosch with Hefe.

Grosch discloses a process for the production of epoxides using an oxidation catalyst based on titanium silicalite zeolite powder. However, Grosch is silent about the use of a pore-forming agent, especially in an amount of 5 to 35% by weight of zeolite. EP '983 discloses the preparation of titanium silicalite zeolites by hydrothermal synthesis from co-precipitated  $\text{TiO}_2\text{-SiO}_2$  impregnated with a templating agent (such as tetrapropyl-ammonium hydroxide or bromide). Still according to EP '983, the co-precipitated  $\text{TiO}_2\text{-SiO}_2$  is prepared from soluble compounds of Ti, Si and O<sub>2</sub> brought into contact under precipitating conditions (page 2, lines 32-37), the resulting co-precipitated  $\text{TiO}_2\text{-SiO}_2$  having a SBET specific surface area higher than 200m<sup>2</sup>/g (claim 3), for instance about 467m<sup>2</sup>/g (Example 1). The preparation of the zeolite from  $\text{TiO}_2$  is not disclosed anywhere. Furthermore, the co-precipitated  $\text{TiO}_2\text{-SiO}_2$  cannot be compared with the  $\text{TiO}_2$  of Hefe, which is anatase  $\text{TiO}_2$ , having a low SBET specific area, typically from 13 to 28 m<sup>2</sup>/g (column 5, lines 11-16).

EP '978 discloses large pore crystalline Ti-Al-silicate molecular sieves prepared from a gel comprising, among others, a Ti source, said Ti source being selected from  $\text{TiCl}_3$ ,  $\text{TiCl}_4$  and  $\text{TiOCl}_2$  (page 6, lines 7-8). EP '978 is silent about  $\text{TiO}_2$  as a starting material.

Furthermore, zeolites are by definition porous compounds, their porosity being due to the mineralizing effects of H<sub>2</sub>O and OH<sup>-</sup> ions on reactive sources of silica (and alumina) in the

presence of cations, and are typically produced from hydrogels (as in EP '978) or with templating agents (as in EP '983) (see Appendix A, Ullmann's Encyclopedia of Industrial Chemistry, "Zeolites," chapters 6.1 and 6.1.1, col. 2, §3).

Last but not least, zeolites typically have a high SBET specific surface area, especially the TS-1 used in the examples of the present invention, which had a SBET about 500 m<sup>2</sup>/g. In contrast, anatase TiO<sub>2</sub> usually has a low SBET specific area, from 13 to 28 m<sup>2</sup>/g, according to Hefe. Thus, again, there was no reason to combine the teaching of Hefe (related to anatase TiO<sub>2</sub>) with the teaching of Grosch (related to zeolites).

In summary, there is no reason at all to add a pore-forming substance to zeolites and, as a consequence, the claimed invention is not obvious.

Furthermore, Applicants respectfully submit that Hefe does not teach or in any way describe an epoxidation catalyst or a catalyst comprising titanium zeolites and/or that titanium dioxide containing catalysts are completely different from titanium zeolite catalysts. For example, titanium present in titanium zeolites of TS-1 type catalysts catalyzes epoxidation reactions, while anatase TiO<sub>2</sub> can only catalyze the H<sub>2</sub>O<sub>2</sub> decomposition. The existence of anatase in active TS-1 samples results in decreased hydrogen peroxide efficiencies in the epoxidation reaction (see Appendix B, page 235, column 1; Section 1, column 1; Section 1, "Introduction"; and Appendix C, Abstract, paragraph 3).

As will be clear to one of ordinary skill in the art, and in view of the aforementioned discussion, one of ordinary skill in the art would not combine the teaching of Grosch with the teaching of Hefe, since Hefe relates to a type of oxidation catalyst which cannot be used as an epoxidation catalyst, as claimed in the present invention. Accordingly, one of ordinary skill in

the art would not have been led to combine HefeLe with Grosch to arrive at the claimed invention.

Moreover, as discussed above, even if one of ordinary skill in the art would have combined the disclosure of HefeLe with Grosch, one would not have been led to add pore-forming compounds to a product which is already porous, i.e. the epoxidation catalyst of Grosch. Again, it must be emphasized that in order for two or more references to be combined in an obviousness-type rejection under 35 U.S.C. § 103(a), there must be some apparent reason why one of ordinary skill in the art would have been led to combine the cited prior art references. Stated differently, there must be some apparent reason why one of ordinary skill in the art would have modified the closest prior art reference, adding to it or removing from it various elements known in the art, to close the gap between the closest prior art and that of the claimed invention. *KSR Int'l v. Teleflex, Inc.*, 550 U.S. 398 (2007). For example, one reason would be if one of ordinary skill in the art had recognized a problem identified in the prior art and had knowledge of a benefit or solution to be achieved by modifying the prior art in order to arrive at the claimed invention. However, prior to the present invention, and in view of the prior art, one of ordinary skill in the art would not have known or had any reason to add pore-forming compounds to a product which is already porous. Therefore, it is not relevant that a titanium dioxide composition described in HefeLe may comprise auxiliaries, such as pore-formers, or that it is known that porosity increases the available surface area of the catalyst, which would favor its efficiency, since Grosch already includes porous material. Accordingly, one of ordinary skill in the art would not have seen a problem with the material of Grosch or recognized any benefit from modifying the material of Grosch, in view of HefeLe. Furthermore, further increasing the porosity of the catalyst of Grosch would actually lead to a decrease in its resistance to attrition,

which is not desirable or suitable. Therefore, the art actually teaches away from increasing the porosity and, thus, away from the claimed method.

In conclusion, as discussed above, and provided in the Strebelle Dec., Applicants have surprisingly found that adding a pore-forming agent in an amount of 5 to 35% titanium zeolite catalysts (which is, by definition, already porous), prepared by extrusion, improves the catalyst activity (e.g., increased kinetic constant related to  $H_2O_2$ ), while the mechanical strength of the catalyst (weight loss through attrition) is not impacted or even improved, provided that a silicon derivative binder is added in an amount of more than 5 and less than 20% by weight of the titanium zeolite. Nothing in Grosch, Hefele or Sepulveda, individually or in combination, teach one of ordinary skill in the art that it is usual to or that one should increase the porosity of a zeolite catalyst which is, by definition, already porous. Furthermore, nothing in the aforementioned cited references teach one of ordinary skill in the art that a good compromise must be found between mechanical strength and catalytic activity, where the compromise is linked to the respective amounts of binder and pore-forming substance.

Based on the foregoing, Applicants respectfully submit that claims 1-3, 5-7, 11 and 13-15 are not obvious in view of the cited prior art.

Claims 4 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Grosch, Hefele and Sepulveda, further in view of U.S. Patent No. 5,965,476 (hereinafter "Balducci"). Applicants respectfully submit that, as discussed above with regard to the rejection of the claims in view of Grosch, Hefele and Sepulveda, the aforementioned references fail to teach or in any way make obvious the subject matter of claims 4 and 8. Further, Applicants respectfully submit that the additional cited reference of Balducci fails to teach or in any way make up the deficiencies of the aforementioned prior art references with regard to the subject



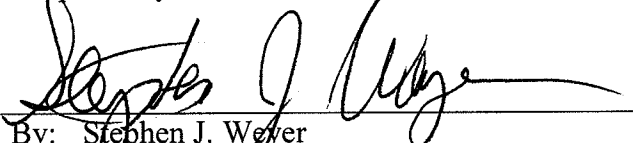
matter of claims 4 and 8. Accordingly, Applicants respectfully request that the rejection to claims 4 and 8 be withdrawn.

Finally, by this Amendment, Applicants have added new claims 16-19, which Applicants respectfully submit are further novel and non-obvious in view of the prior art, as the prior art, individually or in combination fail to teach or in any way make obvious the specific amounts of pore-forming substance added in the process, as claimed.

In view of the foregoing, Applicants respectfully submit that the present application is in condition for allowance.

Respectfully submitted,

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